IN THE UNITED STATES
PATENT AND TRADEMARK OFFICE

PATENT APPLICATION

#3
5-2-01

Applicant(s): **Kravets et al.**

Case no.: **SAR 13896**

Serial No.: **09/769,599** Filed: **January 25, 2001**

Group Art Unit: **2623**

Title: **METHOD AND APPARATUS FOR PERFORMING MOTION ANALYSIS ON AN IMAGE SEQUENCE**

ASSISTANT COMMISSIONER FOR PATENTS
Washington, D.C. 20231

Att: Official Draftsman

S I R:

SUBMISSION OF FORMAL DRAWINGS

The applicants have submitted herewith seven (7) sheets of formal drawings (FIGs 1-10) in connection with the above-captioned application.

Respectfully submitted,

4/17/01

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CERTIFICATE OF MAILING under 37 C.F.R. 1.8(a)

I hereby certify that this correspondence is being deposited on April 20, 2001 with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Michael Ard
Signature

4-20-01
Date of signature

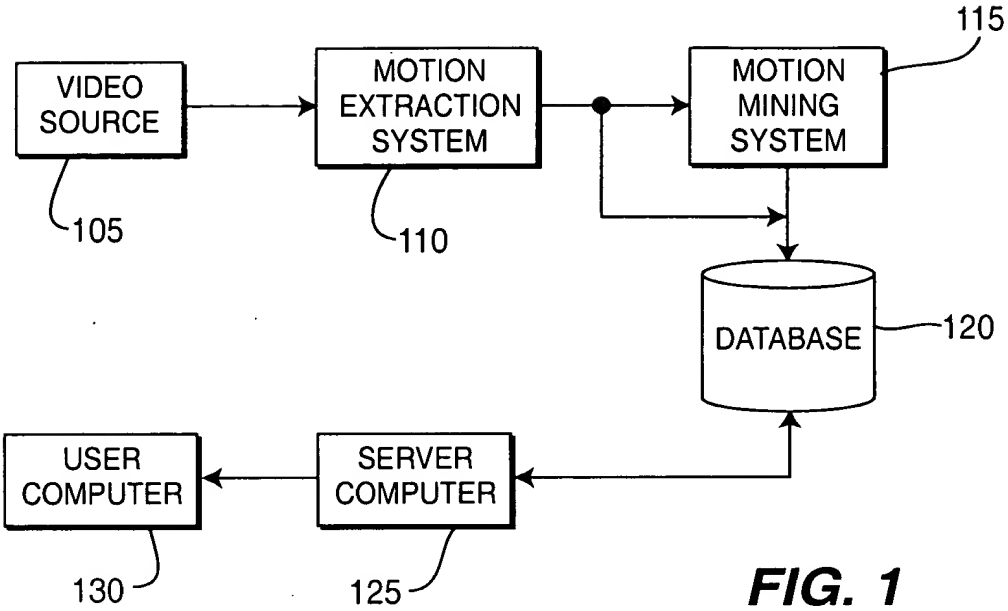

FIG. 1

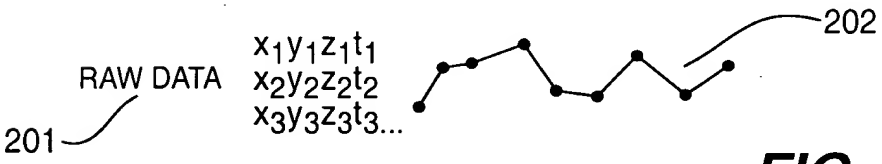

FIG. 2A

MOTION (TRAJECTORY) INFORMATION	SYMBOL	OPERATION ON RAW DATA	EXPLANATIONS
TIME SPAN	T	RANGE	
REGION	R	AREA, $\cap$	
BEGIN POINT	B	$\subset$	CONTAINED IN
END POINT	E	$\subset$	CONTAINED IN
SPEED RANGE	S	$\cap, \subset, \supset$	
DIRECTION	V	$\approx$	
ACCEL RANGE	A	$\cap, \subset, \supset$	
SHAPE	H	$\approx$	
PATH 206	P	, $\approx_t$, $\approx_o$	UNION, TIME SHIFTED, OVERLAP

FIG. 2B

MOTION PATTERNS EXAMPLES	QUERY BASED ON OPERATORS (, ARE USER INPUT/PARAMETERS)
• OBJECT STOPPING	{J: J.A ∩ [-∞,0) and 0 J.S}
• OBJECT MOVING FAST	{J: J.S [,∞)}
• ACTIVE REGION	R = ∩ J_i.R, WHERE |{J_i}| > AND R.AREA <
• SOURCE REGION	R = ∩ J_i.B, WHERE |{J_i}| > AND R.AREA <
• BEATEN PATH	P = J_i.P, WHERE ∀ J_i, |{J_k:J_k ≈$_o$ J_i}| >
• ROAD	BEATEN PATH WITH =1
• CONVOY	= {J_i}: ∀ J_i J_k , WHERE J_i ≈ t J_k AND | | ≥
• RAN A TRAFFIC LIGHT	DEVIATION FROM → TIME
	TRAFFIC DIRECTION { ↓↑→ ↓↑→ ↓↑→
• ILLEGAL PARKING	OBJECT STOPPED WHILE OBJECT IN FRONT MOVES

310

300

FIG. 3

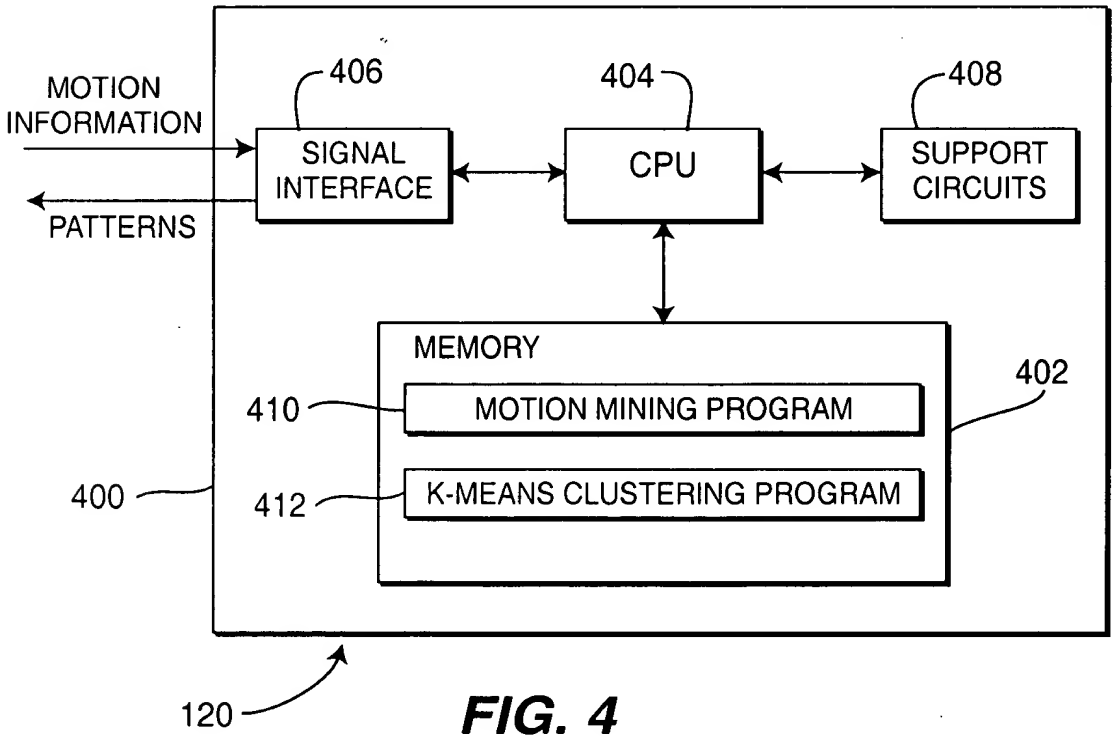

FIG. 4

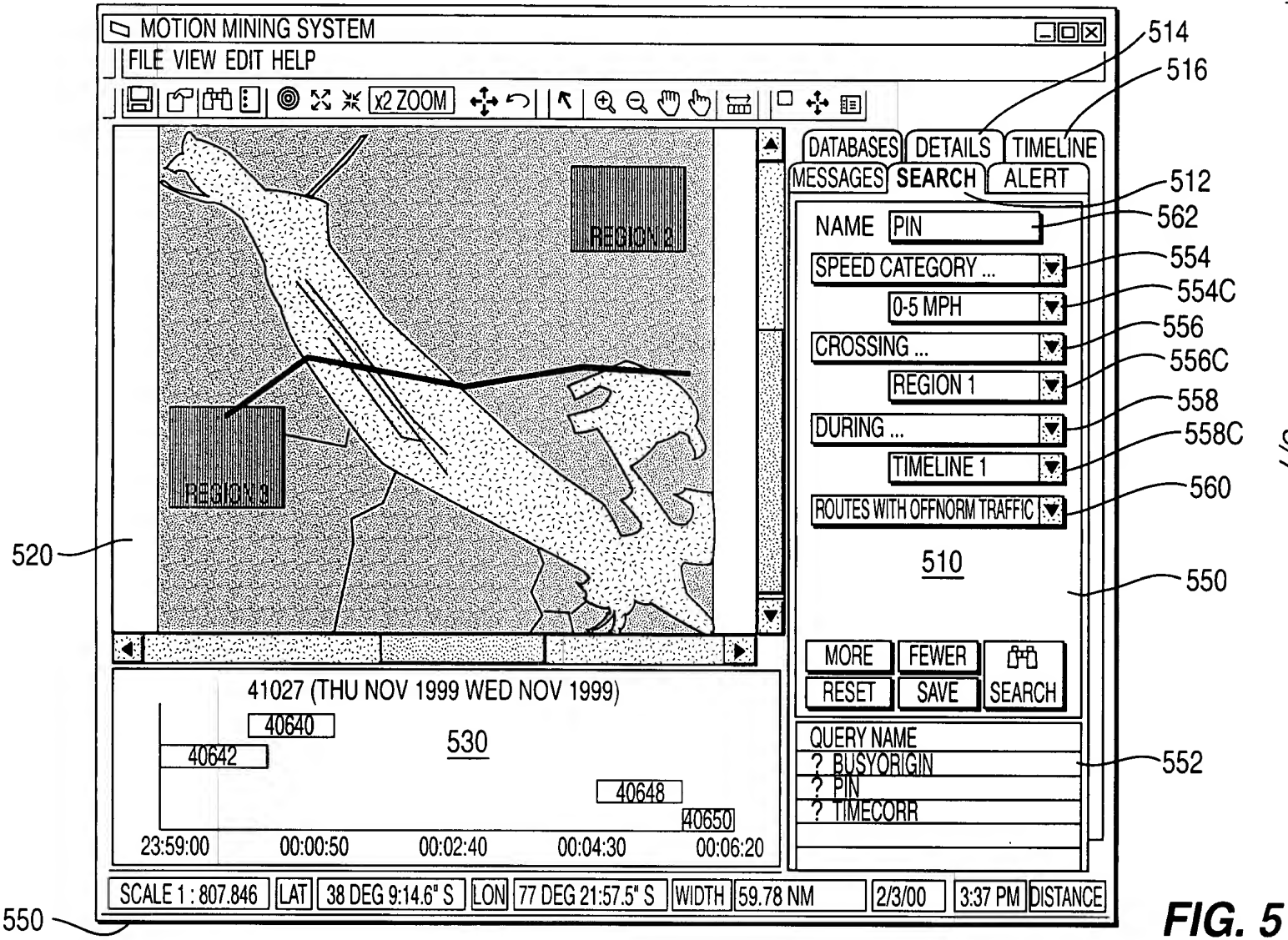
MOTION MINING SYSTEM
FILE VIEW EDIT HELP
x2 ZOOM
REGION 2
REGION 3
DATABASES
DETAILS
TIMELINE
MESSAGES
SEARCH
ALERT
NAME
PIN
SPEED CATEGORY ...
0-5 MPH
CROSSING ...
REGION 1
DURING ...
TIMELINE 1
ROUTES WITH OFFNORM TRAFFIC
510
MORE
FEWER
RESET
SAVE
SEARCH
QUERY NAME
? BUSYORIGIN
? PIN
? TIMECORR
41027 (THU NOV 1999 WED NOV 1999)
40640
40642
530
40648
40650
23:59:00
00:00:50
00:02:40
00:04:30
00:06:20
SCALE 1 : 807.846
LAT
38 DEG 9:14.6" S
LON
77 DEG 21:57.5" S
WIDTH
59.78 NM
2/3/00
3:37 PM
DISTANCE
514
516
512
562
554
554C
556
556C
558
558C
560
550
552
520
550

FIG. 5

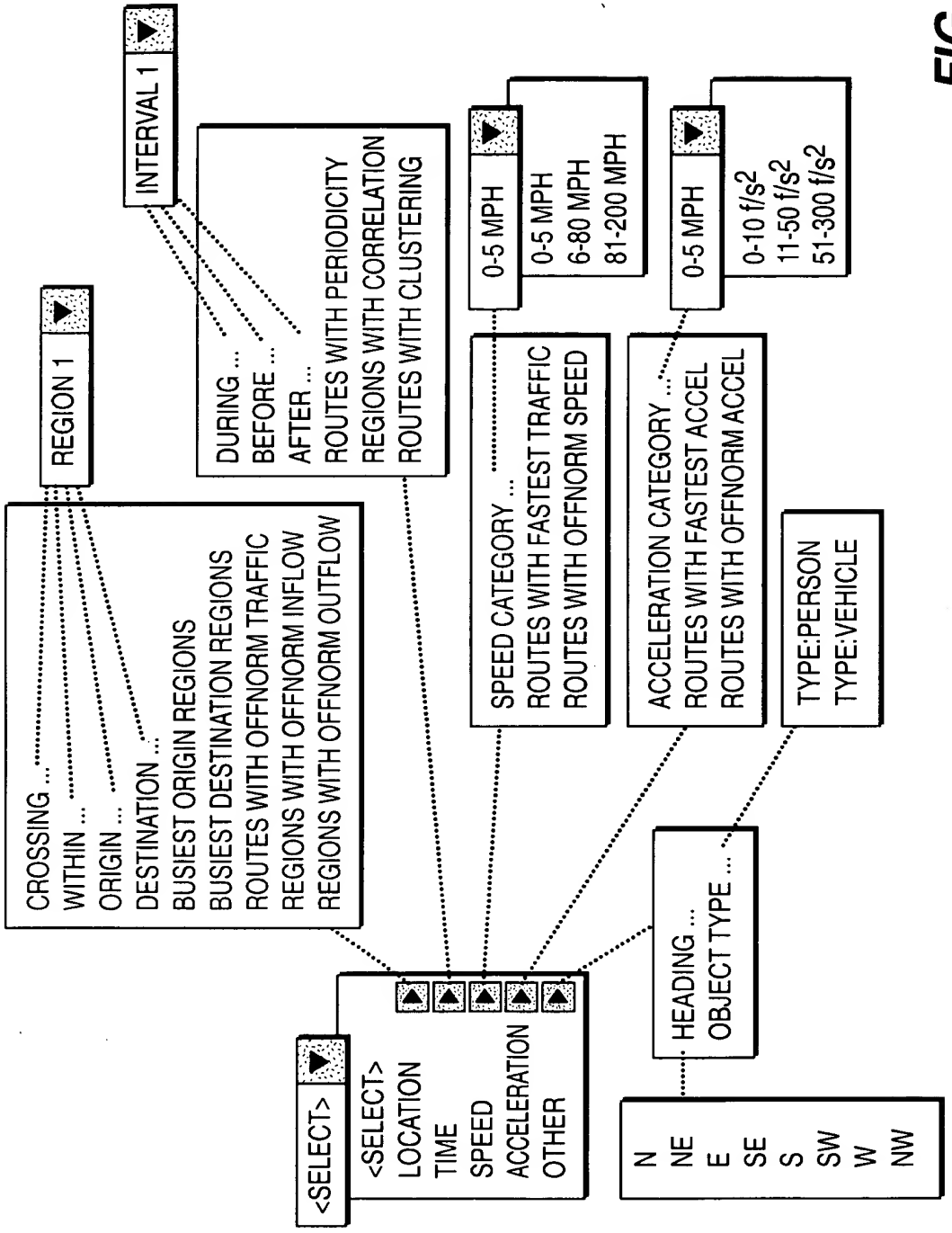
<SELECT>
<SELECT>
LOCATION
TIME
SPEED
ACCELERATION
OTHER
CROSSING ...
WITHIN ...
ORIGIN ...
DESTINATION ...
BUSIEST ORIGIN REGIONS
BUSIEST DESTINATION REGIONS
ROUTES WITH OFFNORM TRAFFIC
REGIONS WITH OFFNORM INFLOW
REGIONS WITH OFFNORM OUTFLOW
REGION 1
INTERVAL 1
DURING ...
BEFORE ...
AFTER ...
ROUTES WITH PERIODICITY
REGIONS WITH CORRELATION
ROUTES WITH CLUSTERING
SPEED CATEGORY ...
ROUTES WITH FASTEST TRAFFIC
ROUTES WITH OFFNORM SPEED
0-5 MPH
0-5 MPH
6-80 MPH
81-200 MPH
ACCELERATION CATEGORY ...
ROUTES WITH FASTEST ACCEL
ROUTES WITH OFFNORM ACCEL
0-5 MPH
0-10 f/s2
11-50 f/s2
51-300 f/s2
TYPE:PERSON
TYPE:VEHICLE
HEADING ...
OBJECT TYPE ...
N
NE
E
SE
S
SW
W
NW

FIG. 6

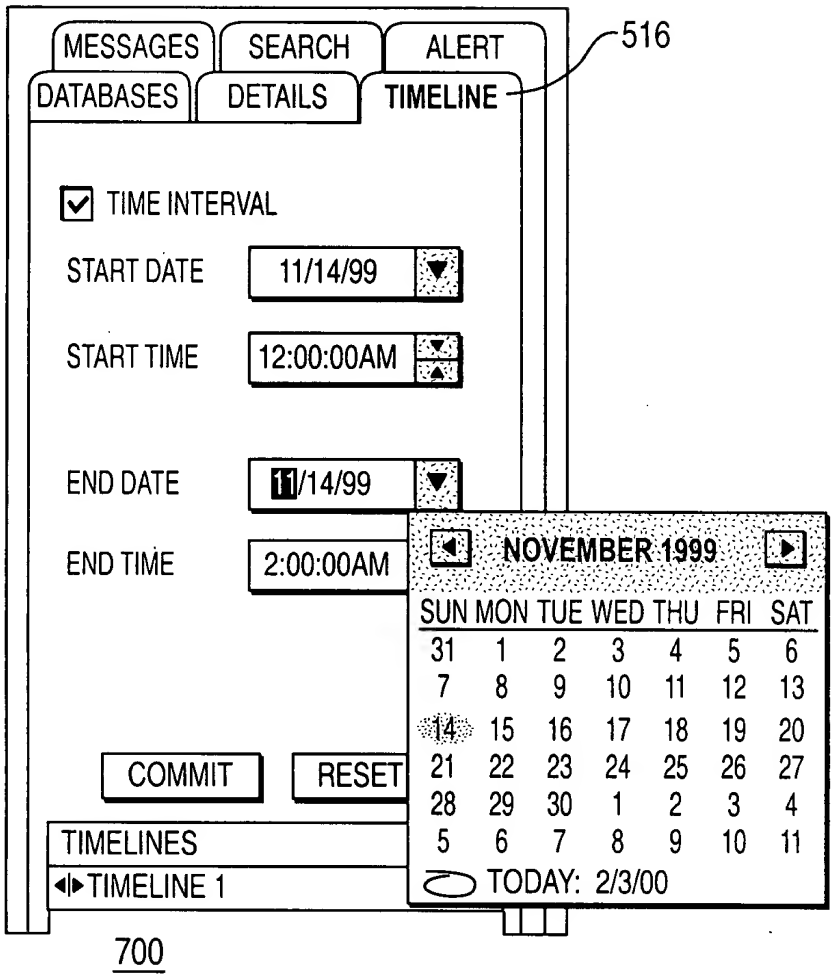
MESSAGES
SEARCH
ALERT
DATABASES
DETAILS
TIMELINE
516
TIME INTERVAL
START DATE
11/14/99
START TIME
12:00:00AM
END DATE
11/14/99
END TIME
2:00:00AM
NOVEMBER 1999
SUN MON TUE WED THU FRI SAT
31 1 2 3 4 5 6
7 8 9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30 1 2 3 4
5 6 7 8 9 10 11
TODAY: 2/3/00
COMMIT
RESET
TIMELINES
TIMELINE 1
700

FIG. 7

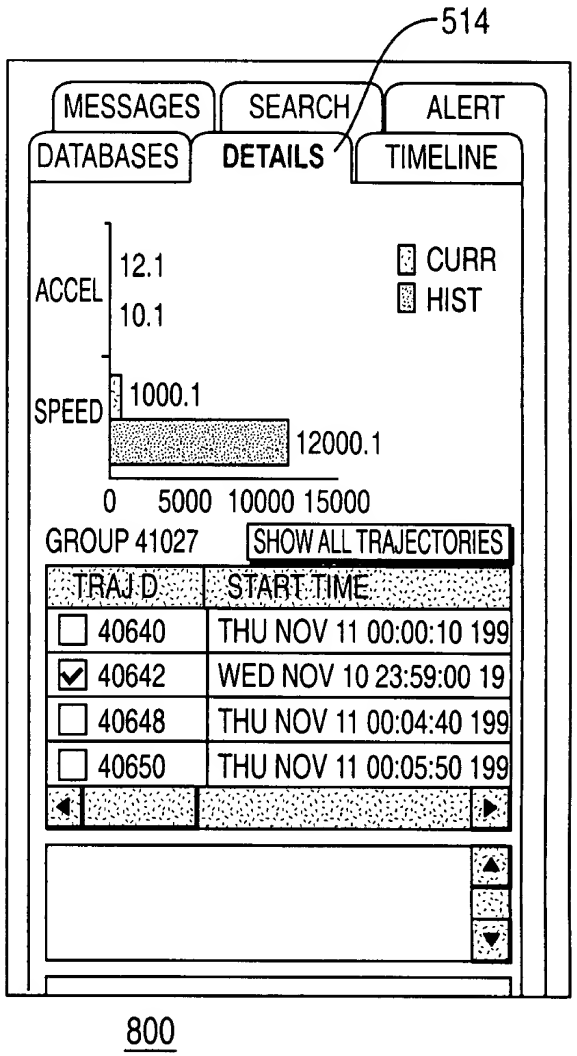
514
MESSAGES
SEARCH
ALERT
DATABASES
DETAILS
TIMELINE
ACCEL
12.1
10.1
CURR
HIST
SPEED
1000.1
12000.1
0 5000 10000 15000
GROUP 41027
SHOW ALL TRAJECTORIES
TRAJ D
START TIME
40640
THU NOV 11 00:00:10 199
40642
WED NOV 10 23:59:00 19
40648
THU NOV 11 00:04:40 199
40650
THU NOV 11 00:05:50 199
800

FIG. 8

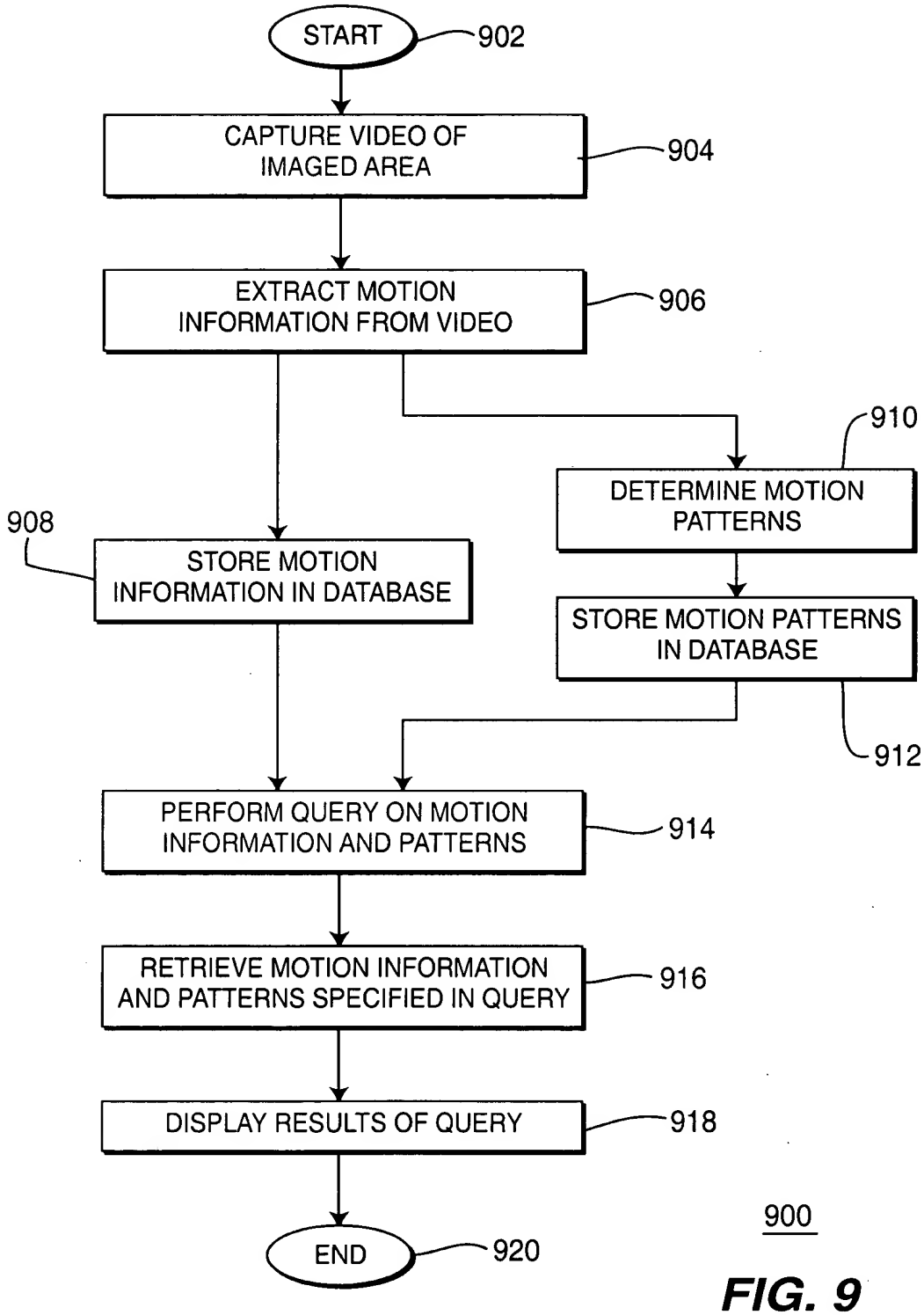
START
902
CAPTURE VIDEO OF IMAGED AREA
904
EXTRACT MOTION INFORMATION FROM VIDEO
906
910
DETERMINE MOTION PATTERNS
908
STORE MOTION INFORMATION IN DATABASE
STORE MOTION PATTERNS IN DATABASE
912
PERFORM QUERY ON MOTION INFORMATION AND PATTERNS
914
RETRIEVE MOTION INFORMATION AND PATTERNS SPECIFIED IN QUERY
916
DISPLAY RESULTS OF QUERY
918
END
920
900

FIG. 9

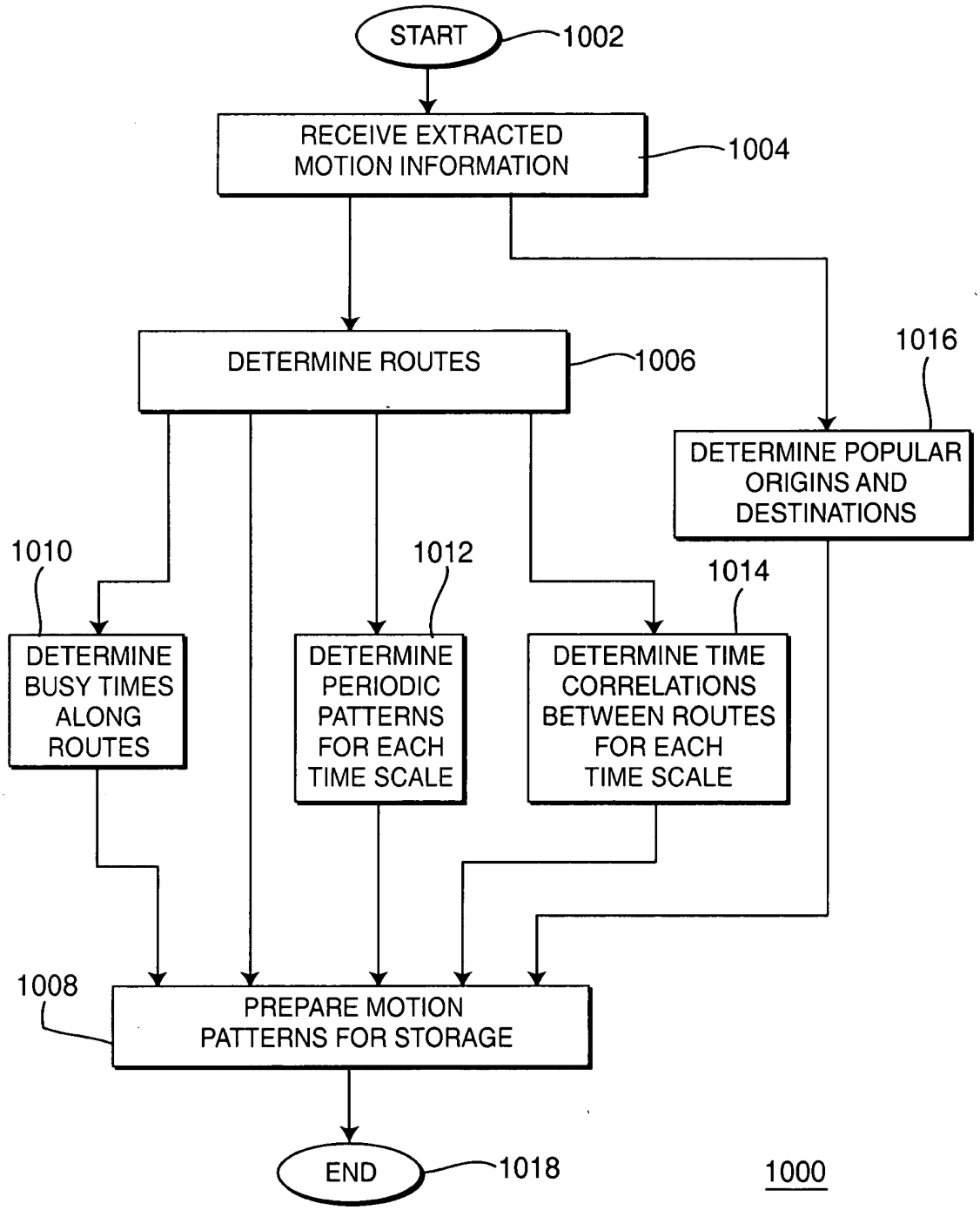
START
1002
RECEIVE EXTRACTED MOTION INFORMATION
1004
DETERMINE ROUTES
1006
1016
DETERMINE POPULAR ORIGINS AND DESTINATIONS
1010
DETERMINE BUSY TIMES ALONG ROUTES
1012
DETERMINE PERIODIC PATTERNS FOR EACH TIME SCALE
1014
DETERMINE TIME CORRELATIONS BETWEEN ROUTES FOR EACH TIME SCALE
1008
PREPARE MOTION PATTERNS FOR STORAGE
END
1018
1000

FIG. 10